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MYCOMYCETES.

Class V.—Ascomycetes. Fructification by sporangia and conidia; sporangia determinate, i. e., asci.	I. Exoasci. † Asci free.	1. Endomycetes. Taphrineæ.
	II. Carpoasci. † † Asci in fruit bodies.	2. Gymnoasci. Perisporiaceæ. Angiocarpous. Pyrenomycetes.
		3. Hysteriaceæ. Discomycetes. Hemiangiocarpous. Helvellaceæ.
Class VI.—Basidiomycetes. Fructification by conidia; no sporangia; conidiophores determinate, i. e., basidia.	I. Protobasidiomycetes. † † † Basidia septate.	1. Uredineæ. Auriculariæ. Gymnocarpous.
		2. Pilacreæ.§ Angiocarpous (in both groups the basidia are divided crosswise).
		3. Tremellineæ.§ § Basidia divided lengthwise, gymnocarpous.
	II. Autobasidiomycetes. † † † † Basidia not septate.	4. Dacryomycetes. Gymnocarpous.§ §
		5. Gasteromyctes. Phalloideæ. Angiocarpous.§
		6. Hymenomycetes. Gymnocarpous and hemi-angiocarpous.

The book certainly deserves a wide reading, and students who are not thoroughly familiar with German will be glad to know that an authorized translation into English is now in preparation and may be expected during the year.—ERWIN F. SMITH.

WARD, H. MARSHALL. *The Diseases of Conifers.* <Jour. Royal Hort. Soc., vol. XIV, Oct., 1892, London, pp. 124–150 (in report of the conifer conference held at Chiswick Gardens, October 7 and 8, 1891).

This pleasant, popular paper discusses two classes of diseases, those due to fungi and those due to disturbing actions of the inorganic environment. The pines, firs, larches, junipers, and other conifers are taken up seriatim. Most of the facts presented have already been recorded, but for the general reader the paper has the great advantage of bringing together the scattered literature and presenting the main facts in a salient, suggestive way.

The premature shedding of pine needles is ascribed to several distinct causes: (1) Sharp frosts or nights so cold that the still tender foliage is chilled beyond recovery; (2) active transpiration when drought has removed the moisture from the soil, or in warm, sunny weather when the ground is frozen hard; (3) the action of various fungi, e. g., *Hysterium pinastri*, which is said to be one of the most prevalent and difficult to deal with.

Some general remarks on nonparasitic diseases of pines are worth quoting in full on account of their suggestiveness, but we must be content with the following:

> Speaking generally, the pines require light, open, and well-drained soils, as deep as possible, and many aspects of disease are due to the nonfulfillment of these conditions.
>
> Unquestionably one of the worst of these dangers results from clogging of the soil at the roots, whether due to wet clay, stagnant water, the covering up or hardening of the surface, e. g., by means of pavements, etc., or other processes.

The general course of events is much the same in all these cases. The primary cause of the injury is want of oxygen at the roots.

Of all the subaerial agents which damage pines, however, none are perhaps more to be feared than the acid gases of our larger manufacturing towns. Sulphurous acid, hydrochloric acid, chlorine, coal gas, and such like chemicals are fatal to pines, even in very small quantities, and it is no doubt to these rather than to the increased percentage of carbon dioxide, soot, or to the diminished light, that the foggy exhalations of large towns owe their enormous power for evil. Nor can we wonder at this when we reflect that many pines are mountain species, growing normally in those purest of atmospheres, which attract us for the very reason of their purity.

Considerable space is devoted to *Nectarina cucurbitula*, to the larch canker (*Peziza*), and to the latest views concerning Uredineous parasites. The European larch is said to be an alpine plant, and most of its diseases affecting it when under cultivation are primarily attributable to the unsuitable environment of lowland regions, especially to the earlier springs.

In this country the diseases of the larch are almost all initiated by late frosts, damp soil, insufficient sunlight, and alternations of periods of drought with periods of excessive moisture, in varying degrees of combination. Late frosts, or chills which approach such, are among the most deadly agents. The tender tufts of bright green foliage, to which the larches owe their spring beauty, are usually forced out in the country a month or six weeks too soon. Once they get well over this early dilatory period of sprouting, all is safe; their safety is insured in their mountain heights (1) by their not beginning to awake from the long winter rest till danger of frosts is practically over, and (2) by the extreme rapidity with which they run through the period of tenderness.

The germinal hyphæ of *Peziza willkomii* will not penetrate the sound cortex of the larch, but a slight frost injury or other wounds enables them to do so.

Trametes radiciperda "attacks the living roots of *Pinus sylvestris*, *P. strobus*, and others, sending its snow-white mycelium beneath the cortex, and traveling thence up the stem to finally penetrate the wood by way of the cambium and medullary rays. The rotting of the wood rapidly follows, with symptoms so peculiar that the presence of this fungus can be concluded with certainty from them." The author says that *T. radiciperda* is "now known very thoroughly from the recent magnificent researches of Brefeld,"* but cites Hartig to the effect that "moats, dug so as to cut off sound trees from infected ones, have been of service."

Agaricus melleus, though a less pronounced parasite, is not less destructive; the details of its action on the timber are different and its mode of spreading from root to root in the soil, by means of its long purple-black, cord-like mycelial strands, called *Rhizomorpha*, also differs. But the net results are much the same in both cases. Very tangible signs of the presence of *Agaricus melleus*, in the absence of the tawny yellow toadstools, are afforded by the copious outflow of resin from the diseased roots and base of the stem of the affected trees, and by the above rhizomorphs in the rotting wood and soil around.

Most of the *Polypori* mentioned are decidedly wound fungi, that is to say, they only attack successfully those parts of the timber which are already dead and exposed to the air; their influence for evil should not be underrated on that account, however, for although they are saprophytes living on the wood, their entrance into the trunk and branches means more or less rapid hollowing of the heart wood (thereby rendering the tree liable to be thrown by winds, etc.) and the gradual production of injurious substances which soak into the sound parts and pave the way for the advance of the destroying mycelium into living organs. Hence, though such fungi are saprophytes, strictly speaking, in their local action, they nevertheless act toward the whole tree taken as an individual as parasites which may induce dangerous diseases.

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* Brefeld's own conclusions in this connection are as follows: "Open isolation moats do not offer the least hindrance to the spread of this fungus, but, on the contrary greatly favor it, by breaking the diseased roots and inducing the formation of an unusual number of spore-bearing organs (see Untersuchungen, Heft VIII, pp. 182–184)."

Remedial measures are, of course, to be directed to the careful tending and covering of wounds, a mode of procedure which has long been carried out on various trees at Kew and with decided success, I believe.

This last is a remark which American street and park commissioners and orchardists might well take to heart.

Prof. Ward happily avoids the fault of many popular writers. There is no effort to conceal ignorance or gloss over difficulties. At every turn the reader is informed of the present limitations of knowledge and of the necessity for further study. Concerning American fungi he writes as follows:

> Farlow and Seymour give a long list of American forms [on the pine] that will necessitate much careful investigation before we can determine which are truly parasitic and which are saprophytic.

After giving Klebahn's recent conclusions, he says:

> Several other forms of *Peridermium* are known on various species of pines. The following have hitherto been included with the above under the common name *P. pini*, but no one will now be so bold as to retain them until further investigations have decided as to their relationships. The forms in question occur on the cortex of *Pinus montana* (Mill.), *P. uncinula* (Ram.), *P. maritima* (Mill.), *P. polepensis* (Mill.), *P. mitis* (Mchx.), *P. taeda* (L.), *P. ponderosa* (Dougl.), *P. rigida* (Mill.), *P. insignis* (Dougl.), *P. sabineana* (Dougl.), *P. contorta* (Dougl.), and some other American pines, as well as on the leaves of the Indian *P. longifolia* (Lamb), and of the American *P. australis* (Mchx.).
>
> *Agaricus melleus* is recorded by Farlow as occurring on *Chamæcyparis sphæroidea* (Spach), and the same authority mentions *Botrytis vulgaris* on Sequoia; whether these are parasitic I do not know, and in fact the whole of the very long list of conifer fungi wants careful overhauling before we can decide as to their share in producing diseases.

Finally, after calling attention to Asterina, Meliola, Coryneum, Dothidea, Pleosporæ, Sphærella, Stigmatea, etc., Prof. Ward makes the following very pertinent remarks:

> With regard to a large number of these forms, and to even more numerous foreign forms, we are as yet quite in the dark as to whether they are parasites or not.
>
> Experience warns us, however, that in many cases epidemic fungous diseases suddenly force themselves on our attention, owing to some form hitherto occurring sparsely and known only to the curious expert, having become suddenly favored in its struggle for existence. I have already given you several examples, notably that of the larch disease, into the life struggles of which we have succeeded in peering rather deeply. Surely such considerations should alone suffice to extend and cement the sympathy between the practical horticulturist and the persistent though perhaps unobtrusive investigator, which, I am happy to see, is becoming more and more pronounced as each understands better the ways and high aims of the other.—

ERWIN F. SMITH.